

# Build A "RadioActive" Wireless Guitar Transmission System

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**H**ave you ever played an electric guitar and got tangled up in all of the long patch cords on the floor? Have you ever just wanted to pick up the guitar and start to play without having to find your guitar amp and plug in the cables and hook up the guitar effects pedals and check to see if the power pack is plugged in, etc., etc., etc.!!?

Well maybe you should consider going wireless!

Almost every serious musician has got (or has thought of getting) his/her own wireless guitar transmission system. So what is stopping everyone from going wireless? Well, maybe price has something to do with it. Lets face it, if wireless guitar transmission systems were the same price as guitar patch cords, everybody would be wireless! Going wireless is simply more convenient than those awkward cables.

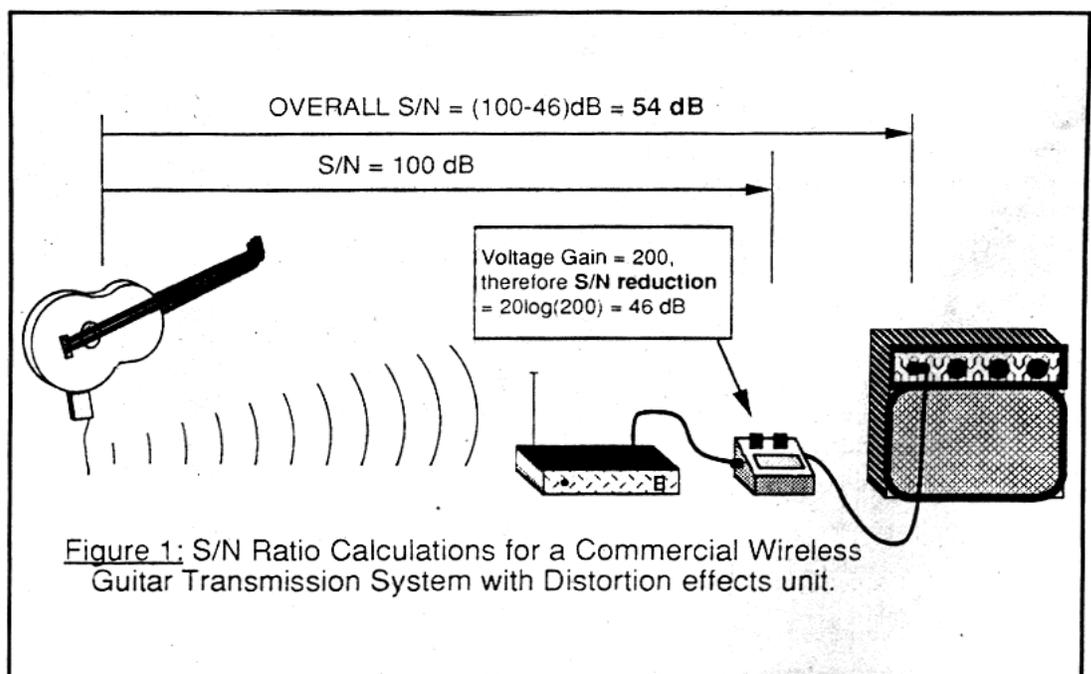
Here's good news: RadioActive Transmissions has finally done something about those ridiculous prices everyone is asking for the wireless guitar transmitters.

Now you can build your own RadioActive Wireless Guitar Transmitter for under \$75 !! And better yet, it has a built-in distortion effects unit so you don't have to mess around with your effects pedals every time you want to play your guitar. Simply plug this baby into the side of your guitar and start playing wireless through your stereo system. Or, if you want to add other effects and that 10,000 watt guitar amp,

you can just plug your FM receiver right into your guitar amp/effects setup. Simple.

Sound great? *Alright*, read on and we'll tell you everything you want to know on how to build your very own RadioActive Guitar Transmission System. First, let's find out what makes the RadioActive transmitter unique.

Wireless guitar transmitters have been around since the late 1960's but



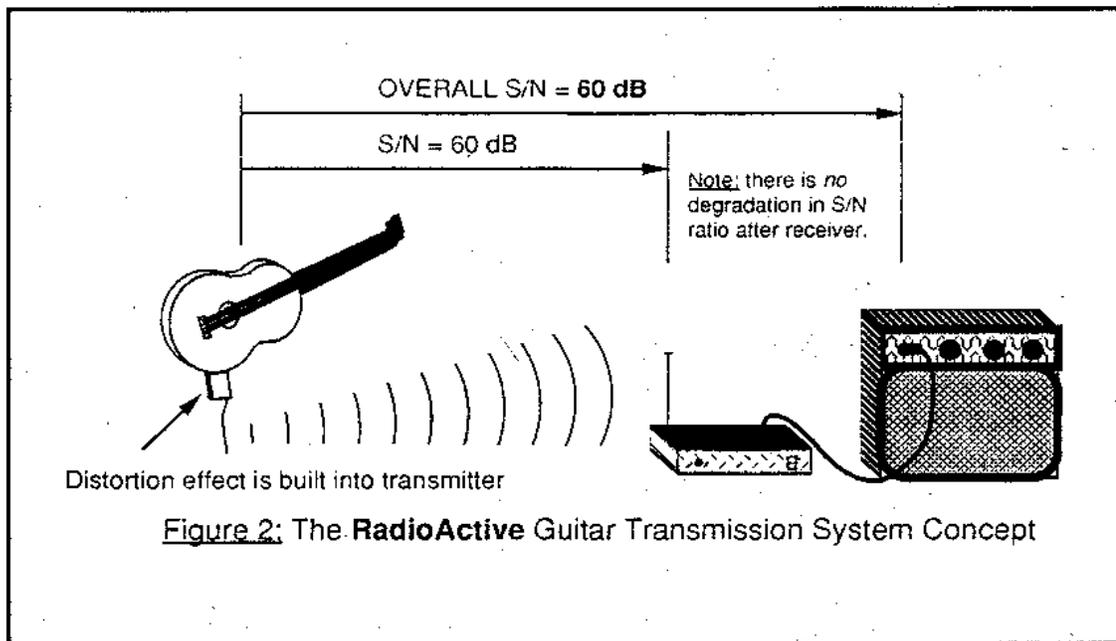


Figure 2: The RadioActive Guitar Transmission System Concept

these early units were either too noisy or too expensive for general consumer use. Hence these wireless systems were affordable only by rock super-groups and the like.

The advent of higher integrated technology led to significant improvements in the signal to noise (S/N) ratio aspects of these early units while also lowering costs. Specifically, these early "affordable" wireless guitar transmitters used

some form of COMPANDING in the transmission process to lower the noise. COMPANDING means COMpressing the dynamic range of the transmitted audio signal and then exPANDING the dynamic range to it's original level at the receiver end. The dynamic range is simply the volume difference between the quietest audio level to the loudest.

While this noise-reduction technique works well most of the time, it suffers

from various problems. The most common of which is a phenomenon known as "breathing" — where you can hear the background noise getting softer and louder as you play the guitar.

Newer forms of affordable wireless guitar transmitters use different variations of COMPANDING to reduce the above mentioned problems but even these units suffer from a hefty price tag.

A high S/N ratio is mandatory if the transmission system is to be used with a distortion effects unit. The reason for this is that any form of

distortion effect is essentially just a high-gain audio amplifier. Therefore if the distortion effect is placed after the receiver in a typical wireless guitar transmission system then everything including the background noise will be amplified. Hence this would result in a lower overall S/N ratio. Figure 1 shows this dilemma numerically. Note that S/N ratios for wireless transmission

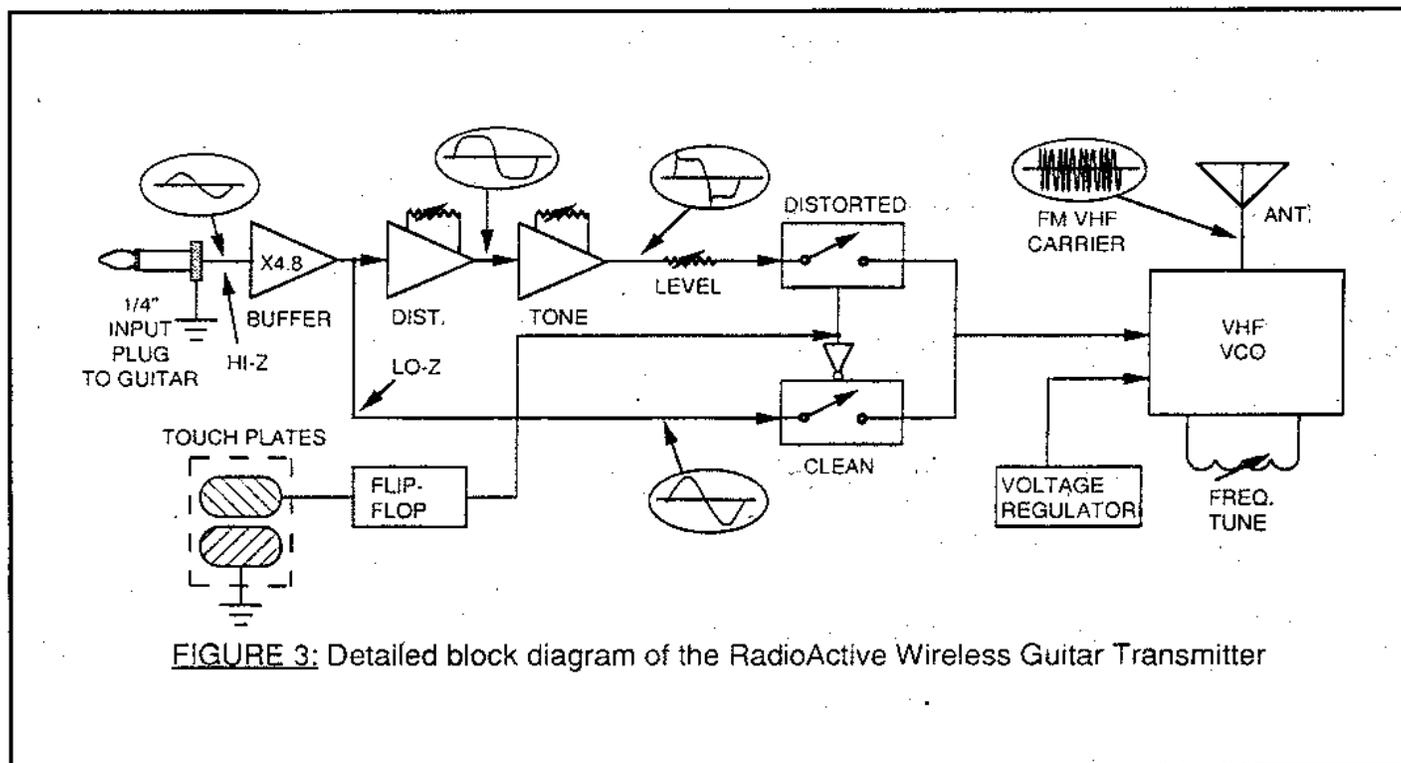
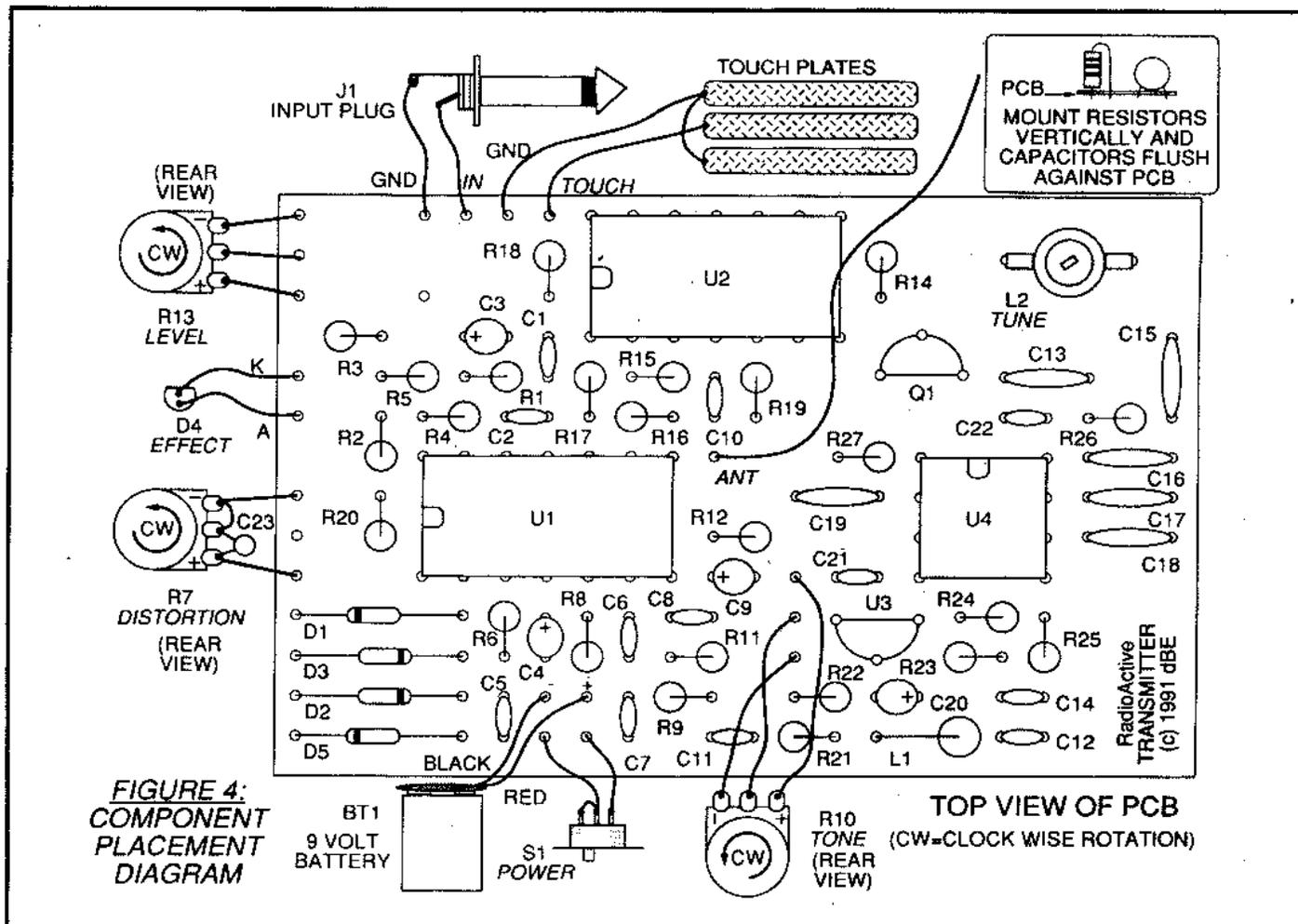


FIGURE 3: Detailed block diagram of the RadioActive Wireless Guitar Transmitter



**FIGURE 4:**  
COMPONENT  
PLACEMENT  
DIAGRAM

systems are rarely over 70 dB unless some form of COMPANDING is used.

The RadioActive transmitter is radically different from the above mentioned systems in that the distortion effects unit is placed *before* the transmitter and hence the effects unit only amplifies the pure guitar signal and not the background receiver noise. This results in a dramatic reduction in audible noise as well as cost since a COMPANDOR is *not* required. See Figure 2 for this innovative new set-up.

In order to reduce costs still further, the RadioActive guitar transmission system uses any portable FM (*Frequency Modulated*) radio as the receiver instead of an expensive crystal-controlled VHF (*Very High Frequency*) receiver.

Figure 3 shows the detailed block diagram for this transmitter. Typical waveforms at various sections of the transmitter are also shown in this diagram. Note that the complete transmitter is comprised of only three distinct circuit blocks. These are: (1) The

Distortion Circuit block, (2) The Touch Switch Circuit block, and (3) The VHF Voltage Controlled Oscillator (VCO) Circuit block.

If you would like a detailed description of the circuit, see the "How It Works" section. Lets now get on to the nitty gritty details of circuit construction.

## Construction

### Component Selection:

All the resistors should be 1/8 watt metal film type. Although this is not an absolute requirement, it is recommended for miniaturization purposes as well as audio noise requirements. Metal film resistors are, in general, lower noise than the carbon composition or carbon film types when used in audio frequency circuits.

Radial lead monolithic capacitors should be used where specified for miniaturization purposes as well. These capacitors usually have a lead spacing

of approximately 0.1 inches. For the 1  $\mu$ F and 10  $\mu$ F capacitors use tantalums instead of aluminum electrolytics. Tantalums are recommended since they are a great deal smaller than their aluminum equivalents. Also tantalums retain their rated capacitance values at high frequencies whereas aluminum electrolytics have an inverse relationship of capacitance versus frequency. Basically, this means that tantalums will do a better job at filtering out stray radio frequency (RF) noise in the power supply than aluminum electrolytics will.

## Board Assembly

This transmitter works best when constructed on the double-sided *Printed Circuit Board (PCB)* designed by (and available from) RadioActive Transmissions. The double sided foil patterns for this circuit board are included at the end of this article. Remember that all holes are plated-through the PCB. As

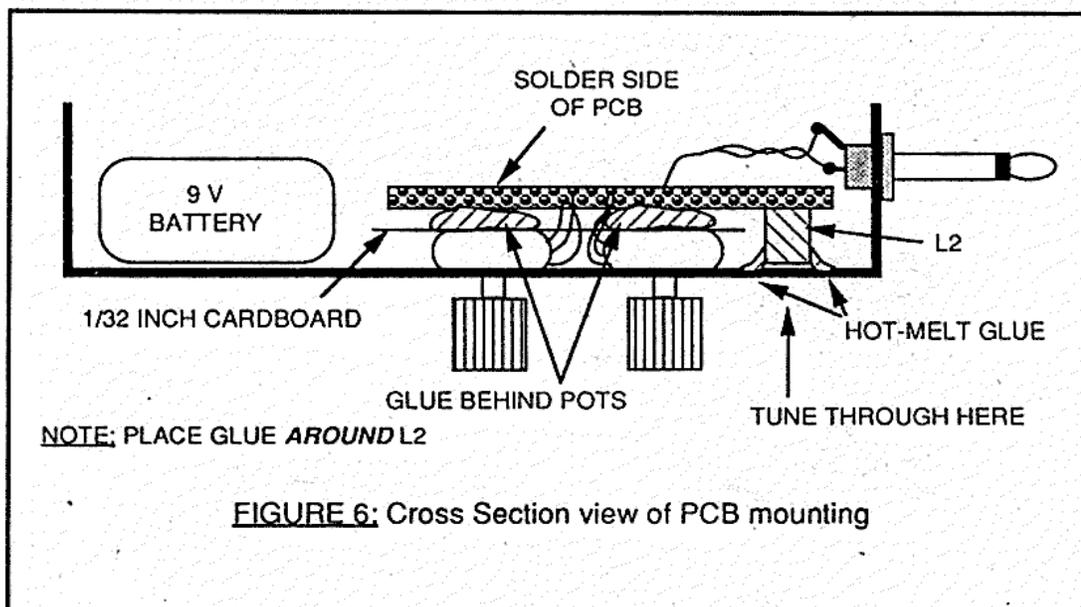


FIGURE 6: Cross Section view of PCB mounting

Observe polarity for the semiconductors and tantalum capacitors. All resistors are mounted vertically. Mount all capacitors flush against the circuit board and keep all leads as short as possible.

After all of the board-mounted components are in place you can wire the potentiometers and power switch using #30 AWG insulated wire-wrap wire. This type of wire is great for making miniature projects. All you have to do is strip approximately 1/16 of an inch of insulation at each end of the wire and solder it in place. Just be careful not

to nick the copper when stripping the insulation from the ends since the wire is very fragile and will break if you bend it a few times.

Use three inch lengths of wire for the off-board components. After these connections have been completed, carefully twist each off-board component. In this manner, the wires will be neater, more secure and also shielded. Be sure to hold the wires at the end closest to the

you can see in Photo 1, the completed prototype unit is neat and very compact when constructed on the recommended pcb.

An alternative method of construction is to use a small piece of perforated board. Regardless of which method of construction you use, keep in mind that this circuit generates RF energy and thus proper component placement is critical. Therefore, we strongly recommend that you follow the parts placement diagram of Figure 4 in order to avoid unwanted high frequency feedback as well as other problems which are associated with RF circuits. Also, keep *all* lead lengths to an absolute minimum in order to reduce stray noise pick-up in the audio frequency section of the transmitter.

The easiest way of constructing this project is to mount and solder each component in the order that they appear in the Parts List. Therefore mount U1 first and then U2 and so on. As you mount and solder each component in the board, you should take a highlighting marker and highlight each component on the schematic diagram as well as on the parts list. This will help you to keep track of the components that you have

mounted and what sections of the circuitry that you have completed.

Do not use IC sockets for any of the ICs since all lead lengths must be kept as short as possible. When soldering any of the semiconductor devices (i.e., U1-4, D1-5 and Q1), a grounded, low-wattage (ie. 15 to 40 watts) soldering iron is recommended. Remember that these devices can be damaged by both the static electricity and the heat applied by the soldering iron.

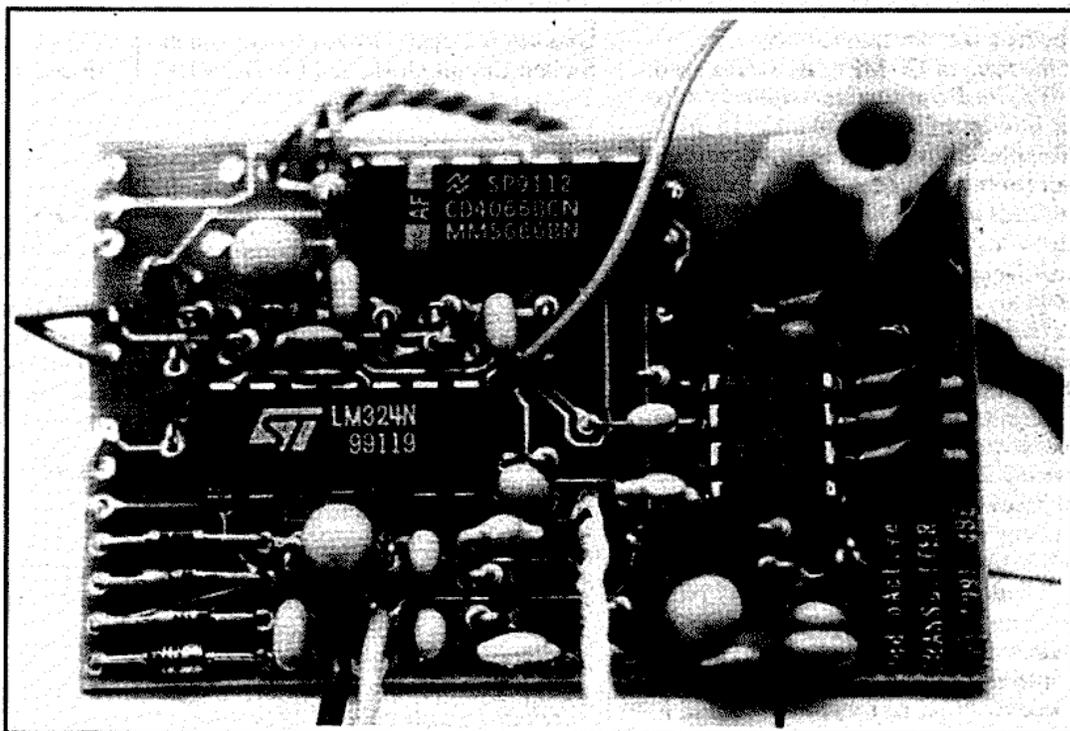


PHOTO 1: Completed Printed Circuit Board

PCB with a pair of needle-nose pliers while you are twisting each component.

Use #26 or #28 AWG flexible insulated wire to connect D4, J1, and the touch plates. Next solder C23 directly to the stationary terminals of R7. This is used to reduce the chances for audible feedback to occur in the high gain distortion section of the circuit.

## Selecting C15

You have to choose one of three different values for C15. The reason for this is that the tuning coil (L2) used for this transmitter is a very high Q type ( $Q=130$  at 100 MHz). Q stands for *Quality factor* and it basically refers to the resolution by which you can adjust the oscillator's operating frequency. Higher resolution translates to a smaller tuning range if the travel of the tuning slug is limited to the length of the coil former.

Hence with this particular coil (#TK2716) the tunable frequency range is limited to approximately 15 MHz. Therefore, since the FM broadcast band spectrum is 20 MHz wide (from 88 to 108 MHz), you have to select one of three standard values for C15. If you use 10 pF for C15 then you should be able to tune across a 15 MHz wide band centred at approximately 98 MHz. The ends of the FM broadcast band may be obtained by using a slightly higher or lower value for C15. Standard component values for C15 are 12 pF for tuning in the lower end of the band, and 8.2 pF for the upper end. The exact tuning range obtained will vary with each unit due to the stray capacitances/inductances introduced by the various lengths of interconnecting wires. Fairly consistent results are possible if you use a PCB instead of a perforated board for construction.

As an option you may want to try a trimmer capacitor with a range of ap-



PHOTO 2: Completed Unit Showing Touch Sensors

proximately 5 to 20 pF for C15. Please note that we have not tried this yet and therefore it is only a suggestion for the dedicated experimenter.

## Antenna

Use an insulated length of 28 gauge flexible stranded black wire for the antenna. The length should be a submultiple of one complete wavelength. For the RadioActive transmitter, one wavelength = (speed of light)/(frequency of operation) =  $(3 \times 10^8 \text{ m/s}) / (98 \times 10^6 \text{ Hz}) = 3.0612$  meters. Therefore the length may be 76.5 cm for a  $\frac{1}{4}$  wavelength antenna or it could be 38.2 cm for a  $\frac{1}{8}$  wavelength antenna, and so on. Note that as the size of the antenna wire is decreased so also is the transmitted signal strength. On the other hand, you cannot increase the length of the antenna to more than 76 cm since this will cause the transmitted carrier to exceed the maximum allowable signal strength level as specified by DOC and FCC regulations. Therefore 38.2 cm is a good choice for the antenna wire length.

The antenna wire can be brought out through a small hole in the bottom of the case. Alternatively, you may try to

glue the antenna wire around the inside perimeter of the box. Of course for this you would have to use 30 gauge wire for the antenna instead of 28 gauge. Also note that this antenna configuration may shorten the effective transmission range of the transmitter

## Touch Sensors

The touch sensors are formed by using three strips of  $\frac{3}{8}$  inch wide self-adhesive aluminum tape. This tape is commonly used for window alarms and is available from Radio Shack (#49-502). Place the tape approximately 3 mm apart on the front panel of the case as shown in Figure 5 and Photo 2. Make connections to the strips of tape by crimping the ends of the tape along with the wire. Connect the outer two strips to ground on J1 and the middle strip to the touch sensor input on the circuit board. Be sure to check the continuity of the connections with an ohm meter. Then insulate the tape-wire junctions with a small amount of hot-melt glue.

## Mounting And Alignment

You will have to cut both pieces of the case (#270-257) to size as shown in

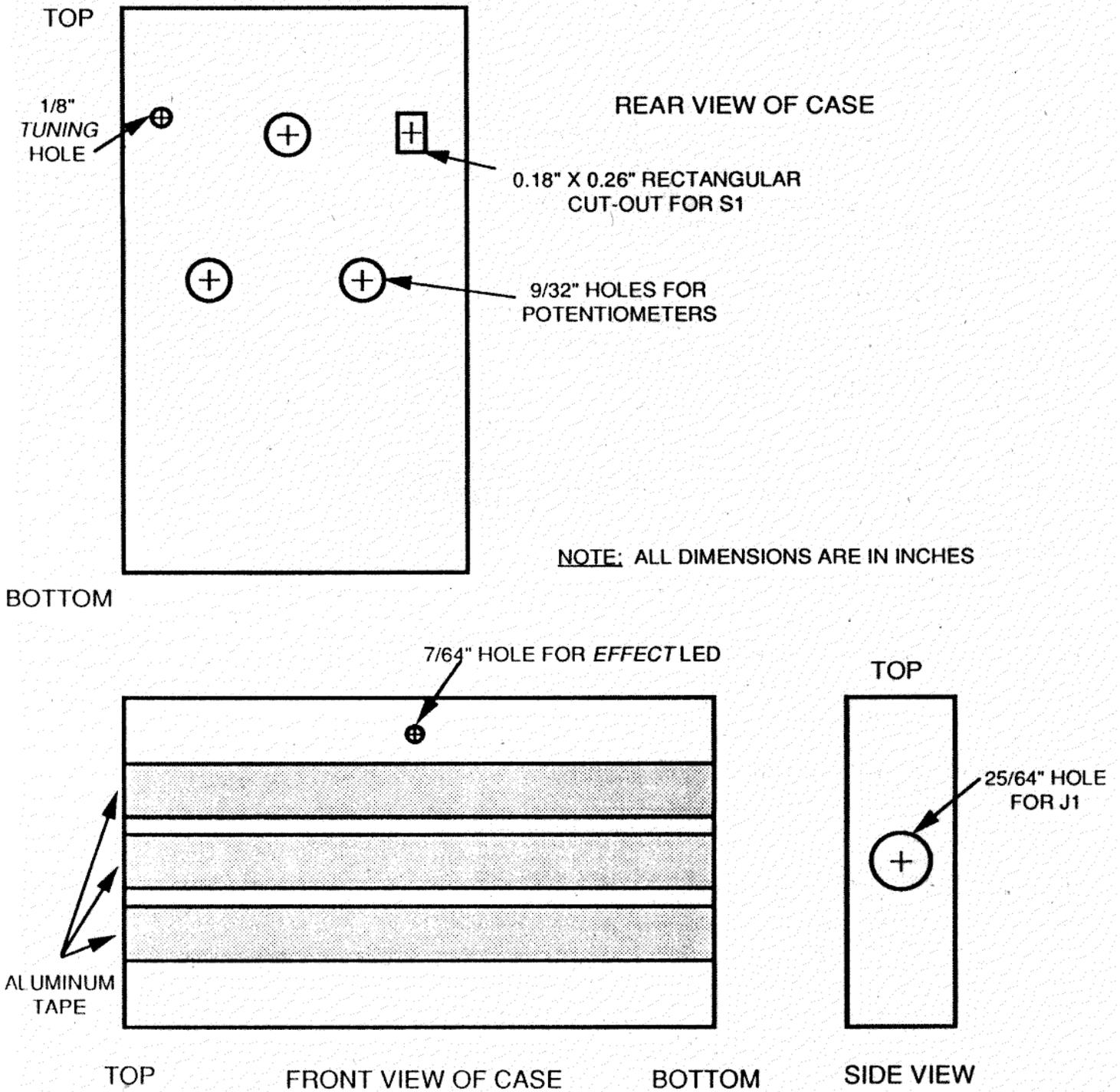
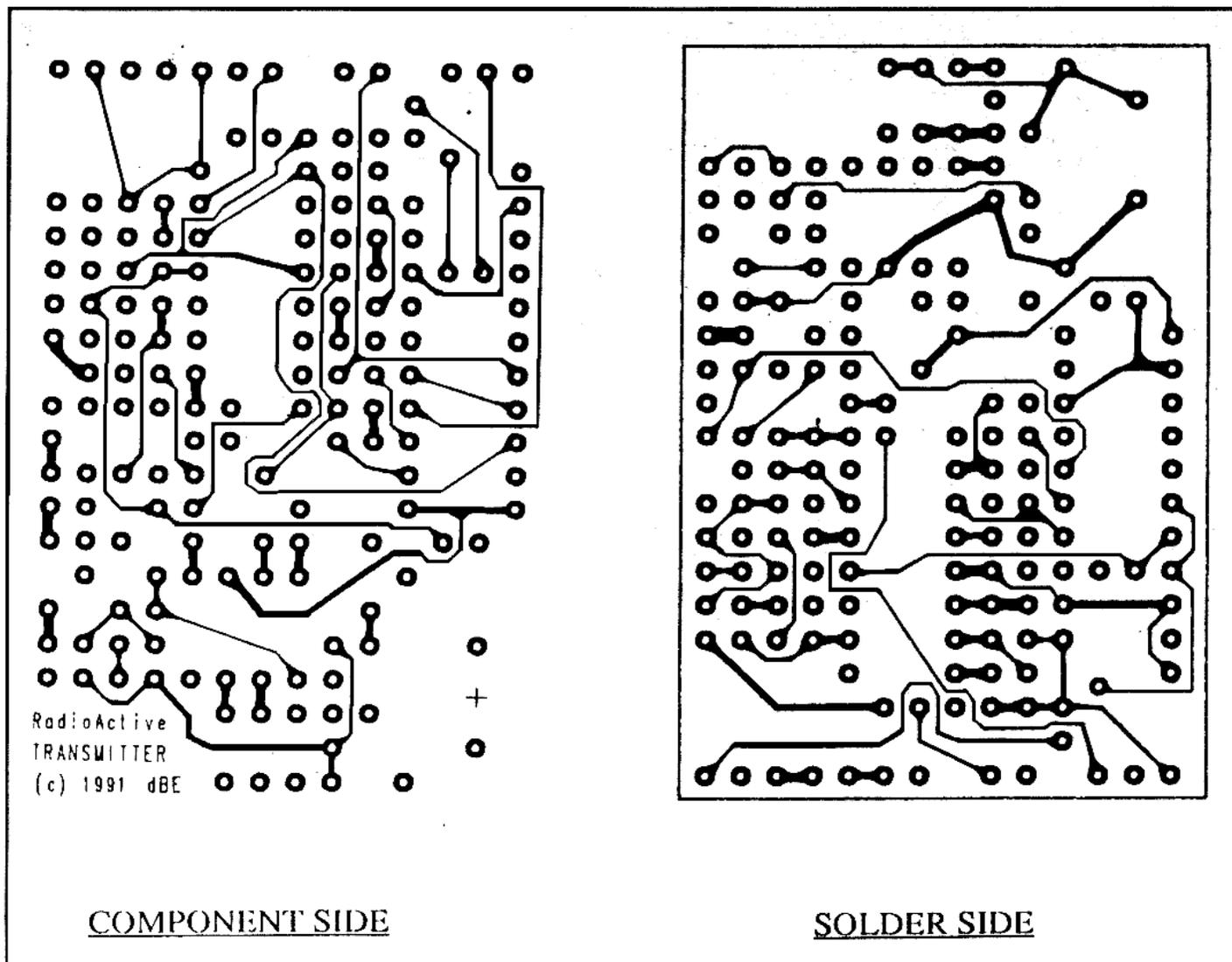


Figure 5: Actual Size Drilling Template for the RadioActive Transmitter's Case



*PCB Foil Patterns - 2X Size (All Holes are Plated-Through)*

Figure 5. Be extra neat when working with this case since it scratches easily. Drill a 0.39 inch diameter hole in the top panel of the case for the input plug as shown in Figure 5. Then screw the 1/4 inch phone plug tightly into the plastic. If the plug is loose, be sure to secure it with a little bit of "hot-melt" glue from an electric glue gun or epoxy cement. Keep in mind that this input plug will be supporting the entire transmitter's weight. See Photo 3 for the mounting and wiring details of J1. photo 3

Drill the remaining holes for the case as shown in Figure 5. Next, cut out the rectangular slot for the slide switch S1. As an option, you could possibly use a micro-mini toggle switch for S1 with a circular mounting hole. Make sure the

height of the toggle switch body is small enough so that it will not interfere with the PCB mounting.

Now, power the transmitter with a fresh 9 volt battery and check to see if you can get the EFFECT LED to turn on/off alternately when you bridge the touch sensors with your fingers. The operation should be "touch-on/touch-off."

If this works, check to see if the unit is transmitting properly. Place a portable FM radio beside the transmitter. Tune the radio to any station in the proper section of the spectrum as determined by C15. Then tune L2 with a non-metallic IF core alignment tool (GC #9300 or equivalent) until the transmitted carrier blanks out the station completely. This should give you

an idea of what frequency you are transmitting on. Next, plug the transmitter into an electric guitar and check to see if the unit transmits the "clean" and "distorted" audio signals.

You should now mount plastic control knobs on the pots. This is so that you do not cause un-intentional AF/RF oscillations to occur when touching the potentiometer shafts with your bare hands.

Verify that the DISTORTION, TONE, and LEVEL controls are all functioning properly. The DISTORTION control should allow you to go from clean to highly distorted sound when the effect is on (ie. EFFECT LED is lit up). The TONE control should allow you to adjust the high frequency response of your electric guitar and



*Completed Unit, Receiver and Printed Circuit Board*

LEVEL should allow you to control the output volume of your "distorted" sound only. Note that when the effect is BYPASSED, only the "clean" sound is transmitted.

Now you can mount S1 and D4 and glue them in place. Next install the potentiometers. After this, you can cut a piece of 1/32 inch thick cardboard to insulate the back of the pots from the

board-mounted components. First, glue the cardboard in place on the back of the potentiometers and then align the PCB so that you can adjust the tuning slug of L2 through the tuning hole in the case. Use hot-melt glue to secure the PCB in place as shown in Figure 6.

Finally, you can slide or snap the case together.

*Congratulations!* You have successfully constructed your very own **Radio-Active Transmitter!**

## Tuning Up

The distortion section is operated and set-up in the same manner as any commercial distortion effects pedal.

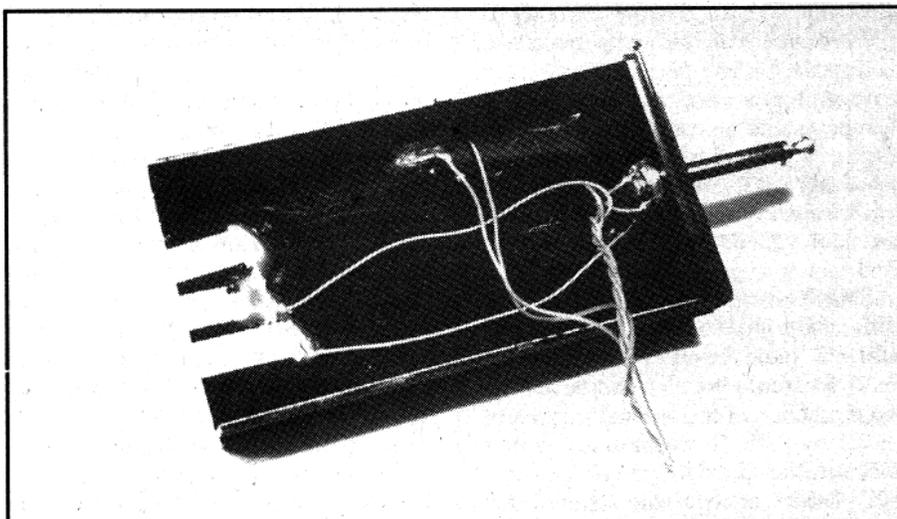
Therefore, while tuning up, you should play your guitar through the clean channel and then switch channels (via the touch switch) so that you can adjust the level control to match the distorted output volume with that of the clean channel's. Note that the volume of the clean channel was set to a predetermined level so that the guitar signal would remain reasonably unclipped with hard playing. Hence this allows for the undistorted transmission of the wide dynamic range inherent in most acoustic/electric guitars.

## Suggestions

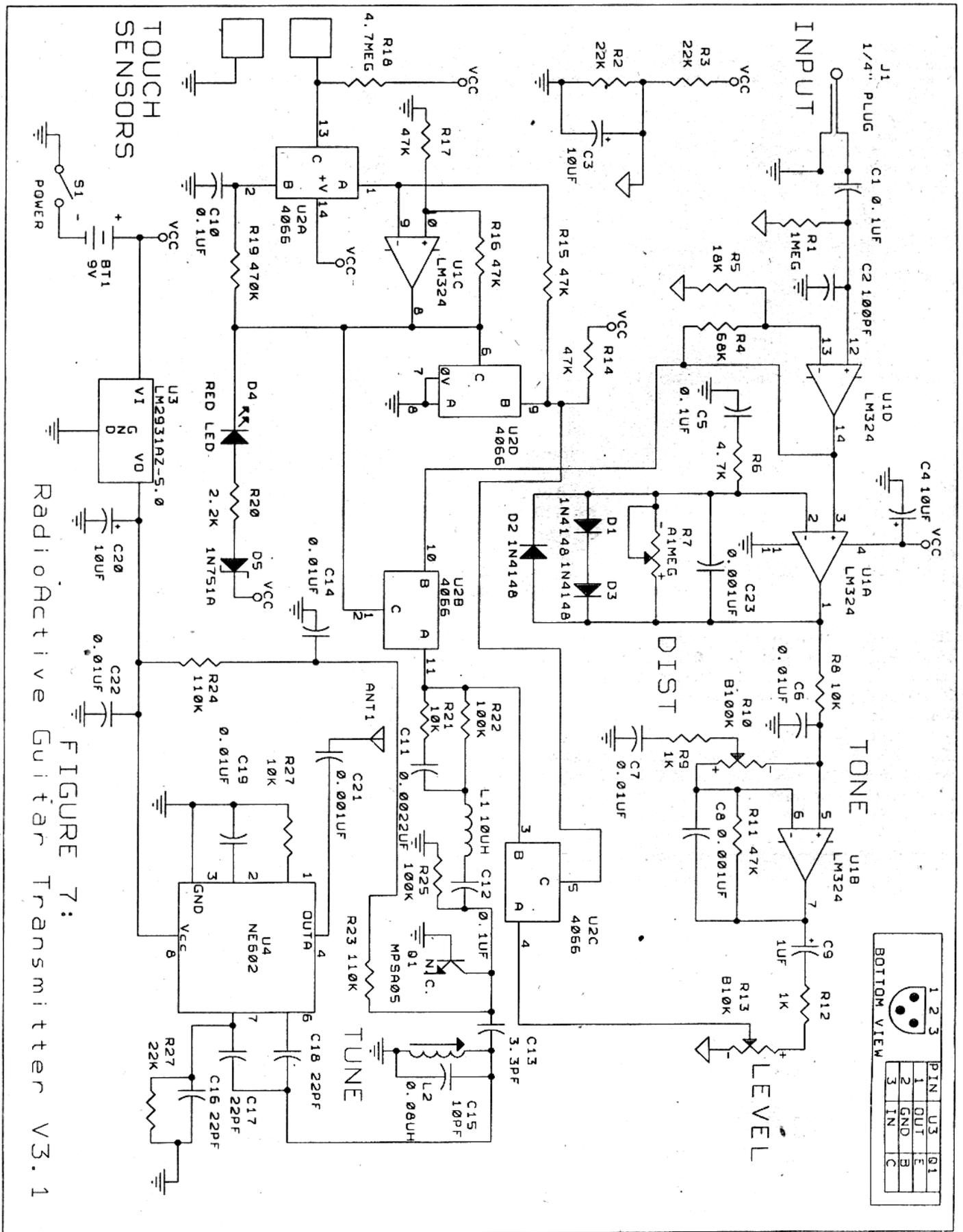
You are now ready to play **WIRELESS!**

Here's a few tips to help you get the most out of this incredible little transmitter.

- Since you are broadcasting on the air you should not operate this transmit-



*Mounting Details of J1*



1 2 3

1 2 3

1	OUT	U3	Q1
2	GND	B	
3	IN	C	

BOTTOM VIEW

FIGURE 7: RadioActive Guitar Transmitter V3.1

ter if it causes objectional interference to nearby receiving equipment.

- Remove the 9 volt battery if you will not be using the transmitter in the near future.
- Use a high sensitivity manual tune FM radio receiver with AFC (Automatic Frequency Control). A good choice is the model RF-502 from Panasonic.
- Use the earphone output jack on the portable radio to connect an external amplifier (ie. electric guitar amplifier).
- and most of all, *HAVE FUN!*

## How It Works

Figure 7 shows the complete schematic diagram of the RadioActive transmitter. Although this may look very complex at first glance, it is really very simple. As mentioned earlier, the transmitter is composed of three distinct circuit blocks which are: the Distortion block, the Touch Control block, and the VHF FM Oscillator block. You may also notice the little (+) and (-) signs on the schematic. These indicate the clockwise rotation of the potentiometers is from the minus sign towards the plus sign.

## Distortion

The purpose of this circuit is to produce a clean (ie. undistorted) audio signal output as well as a distorted signal output. The clean output is produced by using a non-inverting amplifier (U1D) with a gain of  $R4/R5 + 1 = (68K/47K + 1) = 4.8$ .

C1 is used to block the DC components of the input signal. R2 and R3 form a voltage divider to bias the input of the op-amp at approximately one half of the supply voltage ( $VCC=9$  volts). R1 sets the input impedance of the circuit to one megohms. C2 is used to attenuate unwanted ultrasonic frequencies. C3 lowers the impedance of the bias voltage at audio frequencies thereby yielding a cleaner bias voltage supply. C4 performs the same function on the op-amp supply voltage (VCC).

The clean signal is then routed to U2B and also amplified from 1 to 214 times by U1A depending on the setting of the DISTORTION control, R7. R6

and C5 are used to establish a low frequency roll-off (ie. attenuation of low frequencies) of approximately 160 Hz. To produce a distorted signal U1A uses D1-D3 to clip the amplified voltage at asymmetric levels of approximately +0.7v and -1.4v. This form of clipping produces a "raunchy" type of distortion similar in tone to that of an overdriven tube amplifier.

The distorted signal is then sent to the tone control section which is centred around U1B. This section attenuates frequencies above approximately 1KHz when the TONE control (R10) is fully counter-clockwise (ie. the wiper is at the non-inverting input of U1B), and it amplifies frequencies above 1KHz when R10 is fully clockwise.

R8 and C6 form a low-pass filter which attenuates the high frequency components of the clipped waveform produced by U1A. High frequency roll-off for U1B is determined by C8 and R11. The AC voltage gain is determined by R9, R11 and also R10.

Finally, the output level from this op-amp is controlled by the LEVEL control, R13. C9 is used to AC couple R13 from the output of U1B. R12 limits the maximum output voltage level in order to prevent overmodulation of the transmitted carrier.

## Touch Control

Switching between the clean and distorted signals is accomplished through the use of two sections of a *Complementary Metal Oxide Semiconductor* (CMOS) Quad Bilateral Switch IC (U2). U2B and U2C are operated in a complementary fashion by the TOUCH CONTROL section of the transmitter.

U1C is used to form a voltage comparator with hysteresis. This hysteresis is produced through the use of a positive feedback resistor, R16. The reference for this voltage comparator is set at slightly higher than  $+V/2$  by R16 and R17. The entire comparator circuit is used to implement a flip-flop by adding an inverter (U2D and R14) along with a low-pass filter (R19 and C10). The low-pass filter has a time constant of 47 ms to prevent false triggering and high frequency oscillations.

To follow the operation of this flip-flop assume that C10 is initially discharged, U2A is open and U1C is in its true state (where the voltage at the in-

verting input terminal is less than the voltage at the non-inverting input terminal) and therefore its output is at +V level. C10 would then charge through R19 to a value slightly higher than the reference voltage. Now, if U2A was closed momentarily (ie. a low resistance path created between pins 1 and 2), U1C would change state (ie. output drops to zero volts). R15 provides the inverse of the output level of U1C from U2D and therefore keeps U1C in a state of static equilibrium. Hence, C10 would start to discharge through R19. Once C10 was discharged, U2A could once again be closed momentarily to cause U1C to change states again.

This process causes a "push-pull" action, or in other words, this circuit block forms a touch-on/touch-off action touch switch. In actual operation the

## Parts List For The RadioActive Wireless Guitar Transmitter (In Order Of Mounting)

Ref#	Part	Description	Store	Part No.	Note	C2	100pf	Ceramic Disc 10%	M	ME212-2112-101K
U1	LM324N	Low Power Quad Op-amp	Dk	LM324N	*polarity*	L1	10µh	Toko Fixed Inductor (FL-4)	DK	TK3915
U2	CD4066B	Quad Bilateral Switch	Dk	CD4066BCN	*polarity*	L2	0.08µh	Toko Molded Variable Coil (MC115)	DK	TK2101
U4	NE602N	Low Power VHF Mber/Osc	Dk	NE602N	*polarity*					
D1	1N4148	Fast Switching Diode	Dk	1N4148	*polarity*					
D2	1N4148	Fast Switching Diode	Dk	1N4148	*polarity*					
D3	1N4148	Fast Switching Diode	DK	1N4148	*polarity*	Q1	MPSA05	NPN Transistor	DK	MPSA05KS *polarity*
D5	1N751A	500mw 5.1volt Zener Diode	M	592-1N751A	*polarity*	U3	LM2931Z-5.0	Low VO Diff. 5 V Reg.	DK	LM2931Z-5.0*polarity*
R4	68k	1/8 Watt 5 % Resistor	DK	68KE		R7	1meg Pot	Miniature Potentiometer	M	31CN601 *polarity*
R11	47k	1/8 Watt 5 % Resistor	DK	47KE		R10	100k Pot	Miniature Potentiometer	M	31CN501 *polarity*
R14	47k	1/8 Watt 5 % Resistor	DK	47KE		R13	10k Pot	Miniature Potentiometer	M	31CN401 *polarity*
R15	47k	1/8 Watt 5 % Resistor	DK	47KE		C23	0.001µf	Radial Monolithic Cap 10% On R7 Term	M	581-UJEC102J1
R16	47k	1/8 Watt 5 % Resistor	DK	47KE		D4	Red LED	3 mm Dia Red Diffused Led	DK	F363 *polarity*
R17	47k	1/8 Watt 5 % Resistor	DK	47KE		S1	Power	* Sub-Mini Slide Switch Spdt	M	10MS007
R19	470k	1/8 Watt 5 % Resistor	DK	470KE		J1	Input Plug Clip	1/4 Inch Mono Phone Plug 9v Battery Clip	M	17PP202 *polarity* 12BC421 *polarity*
R18	4.7meg	1/8 Watt 5 % Resistor	DK	4.7ME		Box	Black Case Interlocking Two-piece Design Case		RS	270-257
R6	4.7k	1/8 Watt 5 % Resistor	DK	4.7KE		B1	9v Knobs	Battery Blue Insert Knobs For Controls	RS	23-553 *polarity* 274-403
R2	22k	1/8 Watt 5 % Resistor	DK	22KE		<b>Miscellaneous:</b>				
R3	22k	1/8 Watt 5 % Resistor	DK	22KE				Touch Sensors *Self Adhesive		
R26	22k	1/8 Watt 5 % Resistor	DK	22KE				Aluminum Tape	RS	49-502
R20	2.2k	1/8 Watt 5 % Resistor	DK	2.2KE				Knobs Control Knobs	RS	
R1	1meg	1/8 Watt 5 % Resistor	DK	1.0ME				Glue Hot-melt Glue With Glue Gun		
R9	1k	1/8 Watt 5 % Resistor	DK	1.0KE				30AWG Wire, 30 AWG Insulated Wire-wrap Wire		
R12	1k	1/8 Watt 5 % Resistor	DK	1.0KE				28AWG Wire, 28 AWG Insulated Flexible Wire		
R5	18k	1/8 Watt 5 % Resistor	DK	18KE				Tuning Rod I.F. Core Alignment Tool	ES	9300
R23	110k	1/8 Watt 5 % Resistor	DK	110KE				* See Text		
R24	110k	1/8 Watt 5 % Resistor	DK	110KE						
R8	10k	1/8 Watt 5 % Resistor	DK	10KE						
R21	10k	1/8 Watt 5 % Resistor	DK	10KE						
R27	10k	1/8 Watt 5 % Resistor	DK	10KE						
R22	100k	1/8 Watt 5 % Resistor	DK	100KE						
R25	100k	1/8 Watt 5 % Resistor	DK	100KE						
C6	0.01µf	Radial Monolithic Cap 10%	M	581-UJZ103K1						
C7	0.01µf	Radial Monolithic Cap 10%	M	581-UJZ103K1						
C14	0.01µf	Radial Monolithic Cap 10%	M	581-UJZ103K1						
C19	0.01µf	Radial Monolithic Cap 10%	M	581-UJZ103K1						
C22	0.01µf	Radial Monolithic Cap 10%	M	581-UJZ103K1						
C1	0.1µf	Radial Monolithic Cap 10%	M	581-UDZ104K1						
C5	0.1µf	Radial Monolithic Cap 10%	M	581-UDZ104K1						
C10	0.1µf	Radial Monolithic Cap 10%	M	581-UDZ104K1						
C12	0.1µf	Radial Monolithic Cap 10%	M	581-UDZ104K1						
C9	1µf	Dipped Solid Tant Cap 10% 10v	M	540-10M35 *polarity*						
C4	10µf	Dipped Solid Tant Cap 10% 10v	M	540-10M10 *polarity*						
C20	10µf	Dipped Solid Tant cap 10% 10v	M	540-10M10 *polarity*						
C3	10µf	Dipped Solid Tant cap 10% 10v	M	540-10M10 *polarity*						
C15	10pf	Philips Ceramic Capacitor	ES	681 10109 see Text						
C16	22pf	Philips Ceramic Capacitor	ES	681 10229						
C17	22pf	Philips Ceramic Capacitor	ES	681 10229						
C18	22pf	Philips Ceramic Capacitor	ES	681 10229						
C13	3.3pf	Philips Ceramic Capacitor	ES	681 09338						
C11	0.0022µf	Polyester Film 5% Cap	M	140-PF2A222J						
C8	0.001µf	Radial Monolithic Cap 10%	M	581-UJEC102J1						
C21	0.001µf	Radial Monolithic Cap 10%	M	581-UJEC102J1						

### These Are The Addresses For The Recommended Parts Suppliers:

**ES** = ElectroSonic Inc., Order Desk: (416) 494-1555 "in Willowdale, Ontario"

**DK** = Digi-key Corporation "in Thief River Falls, Mn USA" Order Desk: 1-800-344-4539 (toll Free Number Works In Canada)

**M** = Mouser Electronics, "in Mansfield, Tx USA" Order Desk: 1-800-346-6873 (toll Free Number Works In Canada)

**RS** = Radio Shack, Any Local Outlet

### Send Cheque Or Money Order To:

**RadioActive Transmissions**, 45 Bramalea Rd., Box 131, Brampton, Ontario, L6T 2W4

Information: (416) 459-2780

Credit Card Orders: (519) 250-0558

Fax: (519) 250-0560

Parts Kit Is (\$39.95kit + \$2.80GST + \$4.00S/H) = \$46.75  
C.O.D. Orders Add \$5.00

Ontario Residents Must Add 8% Provincial Sales Tax

Please Note All Of The Above Listed Parts Are Available From Radioactive Transmissions For \$39.95 (plus 7% GST And \$4 For Shipping And Handling).this Kit Includes The Double-sided PCB And Alignment Tool.

closed momentarily (ie. a low resistance path created between pins 1 and 2), U1C would change state (ie. output drops to zero volts). R15 provides the inverse of the output level of U1C from U2D and therefore keeps U1C in a state of static equilibrium. Hence, C10 would start to discharge through R19. Once C10 was discharged, U2A could once again be closed momentarily to cause U1C to change states again.

This process causes a "push-pull" action, or in other words, this circuit block forms a touch-on/touch-off action touch switch. In actual operation the touch plates would be shorted by a finger causing the control input of U2A (pin 13) to be grounded and thereby "opening" switch U2A.

The EFFECT LED lights only when the distorted sound channel is selected. Zener diode, D5, along with R20 and D4 form a low battery indicator to show when the battery voltage is falling below approximately 7 volts. Therefore the 9 volt battery should be replaced if

the EFFECT LED is dimly lit when the distorted sound channel is selected.

## VHF FM Oscillator

Finally, the clean/distorted audio signal is fed into the *Very High Frequency (VHF), Frequency Modulated (FM) oscillator* section of the transmitter. Components R21, C11 and R22 form a *pre-emphasis network* to complement the *de-emphasis network* found in most FM receivers. The values chosen for this particular network attenuate frequencies below approximately 700 Hz to produce a "brighter" sound with a lot of "edge" to it.

U4 is used to form a VHF oscillator with an operating frequency of approximately 100 MHz. This operating frequency can be adjusted throughout most of the FM broadcast band (ie. 88 to 108 MHz) by tuning L2 with a plastic rod. Please take note that it is unlawful to broadcast above or below this frequency range with this transmitter. The oscillator is frequency modulated by

using Q1 as a varactor diode. In other words, Q1's collector-base junction capacitance varies in proportion to the applied audio voltage signal. Precision voltage regulator U3 is used to power U4 and supply a stable DC bias for Q1 via R23-25. C14, R23 and R24 form a low-pass filter which helps to filter out unwanted RF from the DC bias supply. C13 limits the net capacitance change of Q1 as seen by the LC (inductor-capacitor) tank tuning section composed of L2 and C15. Hence this in effect limits the frequency deviation of the FM carrier to a maximum of +/- 75 KHz in accordance with DOC and FCC regulations. The VHF FM sine wave is generated by the LC tank section and amplified/buffered by U4. This signal is then AC coupled to the antenna by C21 which also helps to minimize antenna loading effects on U4.

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